PHYS 411/PHYS 542 Introduction to Nuclear and Particle Physics
Fall 2012

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Meeting Time:
T Th 10:50 – 12:05 Herman Brown 453
(With the agreement of the course members, some class meetings may be rescheduled to alternate times to facilitate instructor's travel schedule.)

Prerequisites:
The student is expected to be familiar with Quantum Mechanics at the level of PHYS 311-312 and Special Relativity from PHYS 202.

Course Description & Objectives:
A rigorous first-principles treatment of particle and nuclear requires quantum field theory, a second year graduate course, and the subject demands more than one semester of study. However, a qualitative understanding of the essential physical concepts and phenomena is still possible with an undergraduate background in quantum mechanics and special relativity.
This course is a broad survey of the history and current state of nuclear and particle physics. The emphasis is on experimental results and how they led to our current understanding of the strong and electroweak interactions. In this context, the phenomena of nuclear and particle physics are described. Important applications and some recent advances are discussed in detail.

Textbook:
Nuclear and Particle Physics An Introduction, **Second Edition**
B. R. Martin
J. Wiley & Sons ISBN 978-0-470-74275-4

Additional readings will be made available in owlspace.

Other Resources:
The following books provide additional material and alternative approaches to the main textbook.

Particle Physics 3rd Edition, Martin & Shaw (Wiley).
Same author as main text, with lots of overlap but more depth.

Particles and Nuclei: An Introduction to the Physical Concepts 6th Edition,
B.Povh, K. Rith (Springer)
Similar level as textbook. May be available online through Fondren Library.

Particle Physics: A Comprehensive Introduction, A. Seiden (Addison-Wesley)

Introduction to Elementary Particles 2nd Edition, D. Griffiths (Wiley)
Favored by many for a more rigorous, theoretical approach.

Introduction to High Energy Physics 4th Edition, D. Perkins (Addison-Wesley)
A classical broad survey text, now somewhat dated.

Quarks and Leptons, Halzen and Martin, (Wiley).
A graduate level textbook.

Homework:
Homework will be assigned on owlspace and handed in for credit. Solutions will be provided to aid in understanding of the material. Students are permitted to discuss the homework with each other. However, the assignments should be completed based on each student's individual work.

Examinations:
A take-home midterm exam and take-home final exam will be given during the course. These are "open book" and "open note" exams. No collaboration or discussion on the exam questions is permitted. Questions may only be addressed to the instructor.

PHYS 542 Project:
The graduate course includes an additional project assignment to be completed by the end of the course. Details of the project will be distributed mid-way through the course.

Course Grade PHYS 411:
40% homework
30% midterm exam (take home)
30% final exam (take home)

Course Grade PHYS 542:
20% homework
30% midterm exam (take home)
30% final exam (take home)
20% project

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Schedule: (Subject to revision)

Date	**Topic**	**Readings**
Aug 21-23	Introduction & Basic Concepts	Ch 1
Aug 28-30	(Class meetings to be rescheduled)	
Sep 4-6	Nuclear Phenomenology	Ch 2
Sep 11-13	Particle Phenomenology	Ch 3
Sep 18-20	Experimental Methods	Ch 4
Sep 25-27	Particle Detectors; Quarks	Ch 4, 5
Oct 2-4	Quark Dynamics and Strong Interaction	Ch 5
Oct 9-11	Weak Interaction (No Class Oct 11: Rice Centennial celebration)	Ch 6
Oct 16-18	Weak Interaction	Ch 6
Oct 23-25	EW Unification & Higgs Mechanism	Ch 6 + TBA
Oct 30-Nov 1	Models & Theories of Nuclear Physics	Ch 7
Nov 6 – 8	Applications of Nuclear Physics	Ch 8
Nov 13-15	Open Questions & Future Directions	Ch 9
Nov 20	(Nov 22: Thanksgiving)	Ch 9
Nov 27-29	Current Topics	TBA